The effect of text messaging on 9- and 10-year-old children's reading, spelling and phonological processing skills

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Abstract

This paper reports on an intervention study, which considered the impact of text messaging on 9-10 year old children's literacy skills. 114 children who had never owned a mobile phone before were recruited and randomly allocated to either the intervention or control conditions. All children were pre and post tested on a range of reading, spelling and phonological awareness measures. Children in the intervention group were given access to a mobile phone (enabled for text messaging only) for weekends and during half term break for a 10-week period. It was found that there were no significant differences between the two groups of children in terms of their literacy attainment during that period. However, within the mobile phone group, there was evidence that use of text abbreviations was positively related to gains in literacy skills. Moreover, after controlling for individual differences in IQ, and the children's performance at pre-test, textism usage was able to account for a significant amount of variance in post-test spelling scores. These results show that text messaging does not adversely affect the development of literacy skills within this age group, and that the children's use of textisms when text messaging is positively related to improvement in literacy skills, especially spelling.

Children's use of mobile phone technology is increasing year on year. Not only are mobile phones considered to be 'must have' technology by children, concerns about child welfare are also leading parents to give mobile phones to children at increasingly younger ages: a recent study found that some children in the UK were receiving their first phones at the age of five years (Plester, Wood, & Joshi, 2009). The majority of children aged between 8 and 15 years in the UK and US own mobile phones, and text messaging (SMS) is a popular function of the phones amongst this age group (LSE, 2008; Ofcom, 2008).

Despite its popularity amongst young people, or perhaps because of it, there has been widespread concern in the media about the impact that text messaging may have on children's literacy development. Such concerns have particularly focussed on children's use of text message abbreviations or 'textisms', such as 'CU L8R' or 'anuva fing', when communicating with these devices (e.g. Thurlow, 2006). However, recent studies have shown positive relationships between the degree of use of such spellings and children's performance on standardised tests of reading and spelling. For example, Plester, Wood, & Bell (2008) found that there was a significant positive correlation between the proportion of text abbreviations used by 10 and 11-year-old children (in a standard English-to-text message translation exercise and spelling ability). In fact, use of the two most commonly used types of textism were able to account for 32.9% of the variance in the children's spelling scores. At this point it seemed likely that this positive relationship could be explained by individual differences in phonological awareness in the children, as the textism types commonly used were phonologically based (i.e. they tended to be alternative phonetic spellings of words). So in a subsequent study, which was designed to look at both reading and spelling, Plester, et al. (2009) found that phonological awareness did account for much of the concurrent relationship between literacy skills and textism use in 10-12-year-old children (this time

using an scenario type task which asked the children to imagine that they were in a particular situation, and to write the text message that they would send). However, this study also found that even after controlling for age, short term memory, vocabulary, phonological awareness and how long they had owned a mobile phone, textism use was still able to account for significant additional variance in reading ability. It is not immediately clear what the nature of the additional contribution of textism use to literacy development might be. It could be that the contribution is a motivational one, as textism creation and use is something that is playful and enjoyable. Alternatively, it could be that the extra contribution is simply the contribution of the additional exposure to print which children who text message are likely to experience as a result of daily practice at sending and reading text messages.

The results of such studies are promising as they indicate the potential benefits that such technology may have for children's literacy development, given their widespread use by increasingly younger children. However, these previous studies did have some limitations. For example, for practical reasons, they relied on text messages elicited during contrived tasks rather than on text messages actually sent by the children during their leisure time. Also, the data in these two studies were concurrent, and therefore no direction of causality may be inferred from the associations reported between textism use and literacy skills. As much as we may wish to infer that textism use is contributing positively to literacy skills, it seems equally likely that literacy skills may contribute to textism use. It is therefore essential that the direction of causality is established.

In order to address the issue of causal influences, and to overcome the limitations of previous work in this area, this study evaluated the impact that text messaging has on UK children's literacy skills by giving children who had never owned a phone before the chance to use one, for text messaging only, at weekends and during half term break, for one academic term. The children's phonological skills, reading and spelling were assessed at pre

and post test, and compared to a control group who participated in identical assessment activities and levels of contact with the researchers, but who did not have access to a phone during the intervention period. It was anticipated that the children with access to the mobile phones would show significantly greater increases in literacy performance relative to the control group, after individual differences in IQ had been controlled. It was further predicted that use of textisms by the children in the mobile phone group would be positively related to gains in literacy performance during the course of the study.

A unique feature of this present study is that, as a result of its design, we were able to track the volume of text messages that the children sent and received each week during the intervention period. This also enabled us to consider the contribution that these usage data may be able to make to understanding how text messaging might benefit the children's literacy development.

Method

Participants

114 children aged between 9-10 years (mean age 9;10, SD=5.6 months) participated in the study. They were recruited from 12 schools in the Midlands region of the United Kingdom. All children within the specified age range who attended these schools, and who did not already own a mobile phone were invited to participate in the study. Once written parental consent was obtained, half the children within each class were randomly allocated to the mobile phone group (intervention group) and the other children were allocated to the control group. Where an uneven number of children were recruited within a class, the 'extra' child was allocated to the control condition. This allocation procedure resulted in 56 children in the mobile phone group, and 58 children in the control group.

Test Battery

The *Wechsler Abbreviated Scales of Intelligence* (WASI; Wechsler, 1999) was used in its short form to provide a simple measure of the children's IQ. The vocabulary and matrix reasoning subtests were administered and scored according to the standardised instructions. The standardized IQ score for each child was used in the analysis. The *British Ability Scales II Word Reading Subtest* (Elliot, 1996) was used to measure the children's reading ability. This task required the children to read from an A4 sized card which showed 90 words which become progressively more difficult. No corrective feedback was given to the children during the study and the children's raw scores were converted to ability scores prior to analysis. The *British Ability Scales II Spelling Subtest* (Elliot, 1986) was administered individually to the children according to the standardised instructions which indicated specific start and stop points for each child depending on their age and ability. No corrective feedback was provided at any point during the study and, as with the reading scores, the children's raw scores were converted to ability scores prior to analysis.

Specific subtests from the *Phonological Assessment Battery* (PhAB; Frederickson, Firth, & Reason, 1997) were used to assess different aspects of children's phonological process skills. A broad range of measures were used so that a comprehensive assessment of phonological skills could be provided and examined in relation to textism use, as past research has shown that phonological awareness seems to be linked to textism use (Plester, et al., 2009). Non word reading was administered to provide a measure of decoding ability (which contrasts with reading 'real' words, which may be read by a sight word approach). The maximum score possible on this test was 20. Rhyme detection was used to provide an assessment of broad phonological awareness and required the children to say which two words out of a set of three sounded the same at the end (maximum score = 21). The Spoonerisms subtest was used as a more specific measure of phonemic awareness. In this test the children were asked to substitute the onsets of specific words for either specified

phonemes or to swap the onsets of two spoken words to produce a true spoonerism (maximum score possible =30). The rapid picture naming test was used here as a measure of rapid phonological retrieval and rapid naming is a measure which has been linked to reading disability (e.g. Bowers, & Wolf, 1993; Denkla, & Rudel, 1976). The children were required to name the items presented in a grid of 50 as quickly as they could. This was administered twice and the total time (in seconds) taken to complete the task was noted. The fluency measures from the PhAB were also included as measures of lexical retrieval as they assessed how rapidly the children could access and produce object names from memory. There were three kinds of fluency test. The first was a measure of alliteration fluency which involved the children being timed for thirty seconds during which they were asked to name as many words as what they could that started with specified sounds. During the rhyme fluency test the children were asked to say as many words as they could think in 30 seconds of that rhymed with specified words. In the semantic fluency test the children were given thirty seconds to name as many words as they could which related to certain topics. In each version there was one practice trial and two assessed trials. The scores obtained represented the total number of words produced in each subtest.

General Procedure

Following ethical approval for the study from the university's Ethics Committee, and permission to conduct the study from the headteachers of the schools concerned, letters and consent forms were sent to the parents or guardians of all the children who were aged 9-10 at the school who did not have a mobile phone. The children were then individually briefed and asked if they would like to participate in the study; we made it clear to all children that there was the chance that they would not be selected to receive one of the mobile phones if they did choose to participate. No children withdrew from the study as a result of this briefing. Within each class of children, the eligible children were randomly allocated to either the

mobile phone group or the control group. All children completed the full test battery at the beginning of the study (pre-test phase).

Once the pre-testing was complete the children in the phone group received a briefing on the Friday afternoon about how to use their new phone. The mobile phones were all functionally simple Nokia 1112 models. Basic handsets were selected for this study to minimize the desirability of the phones to other children who were not participating in the intervention, and also to make them easy for the children to learn to use. The children were told how to send and receive text messages, and practiced this in front of the research assistant by sending test messages to each other. They were told they were to have the phones for the next ten weekends and during the week long half term break to text their friends. As the children were novice texters, they were provided with the phone numbers of other children taking part in the project at the same school, so that they had someone to communicate with. However, during the study it became apparent that most children (although not all) had a good network of friends who already owned phones with whom they could text, and parents were also noted as recipients of text messages.

Every phone was given to the children fully charged and with texting credits pre-loaded onto them. The phones were given to the children on Friday afternoons at the end of the school day to reduce any unnecessary disruption to the school. The phones were handed back at school early on Monday morning. These were collected by the research team, and the text messages that were sent by the children were transcribed by hand exactly as they were written on the phones. The research assistants also copied the number of messages sent and received each week from the phones' call logs. The call log was then reset, the phone charged, and new text credit put on the phone, ready for the next weekend. During half-term break the children were given additional credit and were given the charger for their phone.

All children in the study (control and mobile phone groups) were assessed on their reading and spelling only each week. This was done to enable the research team to monitor the children's progress and to see if there was any signs that the phones might be adversely affecting the children's literacy development. Had this been found to be the case, the study would have been terminated for ethical reasons, but there was no sign of the mobile phone group showing declining levels of literacy during the intervention. By testing both groups of children, we were able to ensure that both groups had a broadly similar level of contact with the research team. It should be noted that the same reading and spelling assessments were used throughout the study, which could have resulted in practice effects on these measures. However, as no feedback was given during the tasks there was little apparent evidence of substantial practice effects, and these effects would have been present in both the intervention and control groups, as both groups were tested on a weekly basis during the study.

After the ten week period had elapsed, all the assessments, with the exception of the IQ test, were re-administered to the children in the study (post-test phase). Once the post testing was complete all the children were thanked for their participation in the study. The children in the control group were also given access to the phones for a brief period, so that they could also experience using them.

Results

Table 1 shows the children's performance at pre and post-test on the literacy measures assessed in the study. It can be seen that the two groups of children were comparable in terms of their pre-test performance on the measures, and there is also little difference between the two groups in terms of their post-test improvement. This was borne out by the results of ANCOVA in which IQ and pre-test performance on the measures were entered as covariates before comparing the two groups on their post-test performance on each measure. The

results of these analyses are summarised in Table 1, which shows that there were no significant differences between the groups on any of the literacy measures taken.

Table 1 about here.

As mentioned earlier, in this study we tracked the number of text messages that the mobile phone children sent and received during the intervention, and considered whether there was any influence of these variables on the mobile phone group's literacy development during the period of intervention. The reason for this was because these measures may be seen as a proxy for 'exposure to print' in the context of mobile phone use, and this is something that we would expect to benefit the children's literacy development. Table 2 provides summary statistics for the mobile phone group's phone usage data over the course of the study. It can be seen that there was very enthusiastic use of the phones at the beginning of the study, with participants sending an average of almost 45 messages in that week, but this dropped steadily over the course of the study to just under six by the final week of use. The degree of variation in the numbers of messages sent also reduces steadily over time and a similar pattern is observed for the number of messages that the children received during the study. With respect to their use of textisms, we can see that the textism ratio is roughly the same at the beginning and end points of the study, being somewhat lower than the overall average for the study as a whole.

Table 2 about here

Table 3 summarises the correlations between the degree of improvement observed in the mobile phone group's literacy skills (using composite measures constructed from the children's pre and post test scores), and the number of messages the children sent and received in the first, middle and last weeks of the intervention period. The reason for looking at these time points was because, as shown in Table 2, the children initially experienced a 'hallelujah' effect in which they sent very high numbers of text messages to each other in

their initial enthusiasm with the technology. By the end of the study this had abated and text messaging had become a mundane activity with much lower usage levels, to the extent that a few children were sending no messages at all at that point in the study. By considering the relationships between literacy and sending and receiving messages as these time points we can consider whether any effects observed might be consistent, or are linked to abnormally high levels of text messaging. The composite outcome measures were constructed as follows: the childrens pre test scores were subtracted from their post test scores to give a 'difference' score. These difference scores were converted to z scores so that performance on each test was equally weighted when the scores from the various tests were summed. The 'improvement in reading and spelling' measure comprised the sum of the reading and spelling difference z scores. The 'improvement in phonological awareness' measure comprised the sum of the rhyme and spoonerism difference z scores. Finally the 'improvement in fluency measures' score comprise the sum of the alliteration, rhyme and semantic fluency difference z scores.

Table 3 about here.

Table 3 shows that there were no significant relationships between literacy development during the intervention and number of messages sent and received at the beginning of the study when the abnormally high levels of textism use were evidence, or at the mid point after five weeks. There was some evidence of a significant association between the number of messages sent at the end of the study and improvement in phonological awareness. Interestingly both the number of messages sent and received at the end of the study were linked to improvement on the fluency subtests of the PhAB.

Next, we looked at the associations between mean textism use and literacy performance at pre and post test, and we also looked at mean number of messages sent and received over the course of the intervention (see Table 4). It should be noted that the mean

textism ratio observed amongst this group of novice phone users is much lower than has been observed in other samples;.156 (*SD*=.134) compared to .34 reported in Plester at al (2009). This is in line with what we might expect from a group of children relatively inexperienced in this medium, and data from a cross sectional study of children's text messaging shows that it does usually increase with age / experience (Wood, Plester, & Bowyer, 2009). Mean textism use during the study was significantly associated with most of the literacy skills at pre and post test, which is consistent with other studies of literacy and textism use (e.g. Plester, et al., 2009). This pattern also contrasts strongly with the data on the average number of messages sent and received during the study, where only fluency measures were significantly associated with the average number of messages sent and received.

Table 4 about here.

Finally, we considered whether mean textism use might be able to predict literacy improvement longitudinally after controlling for individual differences in IQ and pre-test performance on the given measures. It was found that textism use could predict a significant amount of the variance in spelling development during the intervention period, R^2 *change* = .086, F=10.488, p=.002, β=.307. This relationship remained even after also controlling for the mean number of text messages sent and received during the intervention, R^2 *change* = .083, F=10.218, p=.002, β=.330. None of the other literacy measures were predicted by mean textism use after controlling for IQ and autoregressors.

Discussion

The main finding from this study was that the children who were given access to mobile phones for the purpose of text messaging did not perform differently to the children who were not given mobile phones in terms of their literacy development. This suggests that although the children with the phones did not benefit significantly from access to the technology, their literacy development was also not adversely affected. The lack of

significant positive benefits is striking given the previous literature on this subject which has shown significant concurrent associations between textism use and literacy development (e.g. Plester, et al., 2008, 2009). However, it seems likely that the duration of the present intervention was not long enough for the benefits of text messaging to become apparent. The interim results of a longitudinal study which studied the development of literacy over the course of an academic year do suggest that textism use impacts causally on spelling development (Wood, et al., 2009). Also, it was noted that levels of textism use in this study were much lower than those previously reported in other studies, because of the children's relative inexperience with the technology. It seems likely that if a longer period of intervention was undertaken that would enable the children to became more prolific users of text abbreviations, and there may have been stronger evidence of impact. Similarly, in order to get support from schools, it was necessary to restrict the children's access to the devices: the children were only allowed to use the phones during weekends and the half term break, which was just one week long. This does not reflect children's usual pattern of access and use when they own their own mobile phones, and is likely to have restricted the impact of the technology on the children's learning. It is therefore important to note that this study underscores the message that it is not having a mobile phone per se that is beneficial, but rather the use of textisms when text messaging which is linked to benefits in literacy development.

This suggestion is borne out by the data we obtained from the children in the mobile phone group. That is, for this group, despite more limited levels of textism use, there was still evidence of a significant contribution of textism use to the children's spelling development during the study. This finding is significant as not only were individual differences in IQ controlled in this analysis, but pre-test performance on the spelling measure was also a covariate; the period of intervention was only 10 weeks in duration, and so the

degree of association between the spelling scores taken at pre and post test was high, which makes this result noteworthy. So there was some evidence that the children's text messaging behaviour had the potential to impact significantly on their literacy skills, but relative to the control group these advantages were not sufficiently marked in the present study. Similarly, the correlational data showed that mean textism use was significantly related to literacy outcomes within the mobile phone group.

These results are in line with those of past work in the area (e.g. Plester, et al,, 2008, 2009; Wood, et al., 2009). The reason for this association between spelling and textism use is partly explained by the highly phonetic nature of the textisms that are popular within this age group, as the phonological and alphabetic awareness that is required for the construction and decoding of these textisms also underpin successful reading development (e.g. Adams, 1990). However, it is also possible that textism use adds value because of the indirect way in which mobile phone use may be increasing children's exposure to print outside of school.

One way of assessing this idea that print exposure might be contributing to literacy skills was to examine the number of text messages sent and received by the children during the intervention period, as these data are an appropriate proxy for phone-based print exposure. This study is the first to collect and analyse such data in relation to educational outcomes of children. The correlations in Tables 3 and 4 show that the only literacy variables that were related to number of messages sent and received were the fluency subtests of the PhAB. It will be recalled that these measures were included as measures of lexical retrieval. It would therefore seem appropriate to find that improvements in lexical retrieval are linked to mobile phone behaviours that involve reading and composing text messages. It would seem that such behaviours enhance children's word finding skills. This suggests that while the 'exposure to print' explanation of the relationship between texting and literacy is not supported, but that exposure to print through mobile phones does impact on other language

skills which relate to the representation of lexical items in memory. Further research into lexical processes and text messaging is required to understand the exact nature of this relationship.

The relative lack of use of the mobile phones at the end of the study was also worth commenting upon when considering the lack of a significant difference in outcomes between the groups in this study. That is, the children were quick to explore and personalise their new phones as far as the basic models that we provided them with would allow. The children were provided with very basic phones because we were interested in their use of the text messaging function and we did not want this effect to be affected by other aspects of the phones' functionality. However, the limited functionality of the handsets we provided did result in some lack of engagement with them over time.

In summary this study has shown that allowing children access to mobile phones for text messaging over a 10 week period does not significantly advantage or disadvantage the children. However, textism use during texting was linked to spelling development and the number of messages sent and received was linked to lexical retrieval skills.

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Table 1:

Descriptive Statistics on Measures by Group (SD in parentheses).

Assessment		Control Group	Mobile Phone Group	F (p)
Reading				
	Pre	142.1 (24.9)	143.9 (23.2)	
	Post	153.0 (25.4)	156.4 (24.3)	.775 (.381)
Spelling				
	Pre	109.8 (19.8)	109.8 (22.7)	
	Post	116.2 (19.2)	117.8 (20.9)	.143 (.706)
Rhyme Detection				
	Pre	17.9 (3.7)	17.5 (4.2)	
	Post	18.2 (4.0)	18.2 (3.7)	.480 (.490)
Spoonerisms				
	Pre	20.4 (7.0)	20.4(6.5)	
	Post	21.4 (5.7)	22.5 (5.4)	1.381(.243)
Nonword Reading				
	Pre	16.1 (4.2)	16.0 (4.1)	
	Post	16.5 (2.9)	17.2 (3.3)	2.105 (.150)
Rapid Picture Naming				
	Pre	97.6 (20.3)	96.5 (20.4)	
	Post	94.6 (21.4)	94.3 (22.2)	.008 (.927)
Alliteration Fluency				
	Pre	11.3 (3.8)	11.4 (4.4)	
	Post	11.5 (4.2)	11.7 (4.0)	.002 (.883)
Rhyme Fluency				
	Pre	11.8 (4.5)	9.6 (3.2)	
	Post	11.8 (4.1)	10.9 (4.6)	.760 (.385)
Semantic Fluency				
	Pre	22.2 (5.2)	20.6 (5.03)	
	Post	20.2 (4.5)	19.4 (4.4)	.349 (.556)

Table 2:

Descriptive statistics for the mobile phone group's use of the mobile phones (SD in parentheses).

	Week 1 Mean	*Week 5 Mean*	*Week 10 Mean*	*Overall Mean*
No. of Messages Sent	44.9 (38.4)	14.5 (19.9)	5.9 (13.8)	19.5 (16.7)
No of Messages Received	51.4 (41.2)	16.1 (25.4)	5.2 (5.2)	19.7 (17.0)
Textism Rato	.129 (.121)	.157 (.174)	.120 (.183)	.156 (.133)

Table 3:

Spearman Correlation Coefficients showing the strength of association between literacy improvement and numbers of text messages sent and received at the beginning and end of the study (= p<.05).*

	Week 1 Sent	Week 1 Rec'd	Week 5 Sent	Week 5 Rec'd	Week 10 Sent	Week 10 Rec'd
Improvement in Reading and Spelling	.242	.171	.149	.096	.132	.074
Improvement in Phonological Awareness	.057	.059	-.076	-.060	.324*	.142
Improvement on Fluency Measures	.158	.225	-.009	-.053	.408**	.390**
Improvement in Rapid Naming	-.219	-.154	.157	.100	-.243	-.145

Table 4

Spearman correlation coefficients to examine the relative associations between textism usage, number of messages sent and received, and performance on the literacy measures.

	Mean Textism Usage	**Mean No. of Messages Sent**	**Mean No. of Messages Received**
Pretest Variables			
Reading	.307*	.086	.132
Spelling	.281*	-.060	.006
Rhyme	.295*	.013	.061
Spoonerisms	.438**	.033	.095
Nonword Reading	.371**	.074	.124
Rapid Naming	-.398**	-.156	-.112
Alliteration Fluency	.292*	.104	.141
Rhyme Fluency	.324*	.252	.224
Semantic Fluency	.095	.288*	.268*
Post Test Variables			
Reading	.227	.109	.141
Spelling	.390**	.017	.119
Rhyme	.200	.011	.093
Spoonerisms	.401**	.003	.033
Nonword Reading	.281*	.007	.134
Rapid Naming	-.438**	-.096	-.052
Alliteration Fluency	.144	.125	.099
Rhyme Fluency	.324*	.362**	.368**
Semantic Fluency	.244	.131	.063